Draft Staff Report for Scientific Peer Review for the Amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California, Mercury Reservoir Provisions — Mercury TMDL and Implementation Program for Reservoirs

Statewide Mercury Control Program for Reservoirs

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SUMMARY

This summary provides a plain-language overview of the Statewide Mercury Control Program for Reservoirs.

The Water Boards recognize that reservoirs are vital to California and that reservoir operations face challenges from floods, droughts, and climate change. Especially in response to challenges posed by climate change, reservoir operators will likely need to nimbly manage water chemistry that could change from year-to-year. Therefore, this mercury program addresses controllable water quality factors and does not impose any restrictions on water supply.

In the first decade, reservoir owners and operators would test feasible reservoir management actions. The Water Boards encourage a coordinated approach for fewer, focused tests rather than tests in all mercury-impaired reservoirs. The test results will be evaluated by an independent, third-party Technical Review Committee before the Water Boards would develop long term requirements for all mercury-impaired reservoirs.

While the reservoir testing program is underway, the Water Boards will ensure that mercury sources are controlled to all mercury-impaired reservoirs.

S-1 Problem Statement, Goals, and Scope

Problem statement

Harmful levels of methylmercury in fish are a statewide and nationwide problem. Mercury is a bioaccumulative toxic pollutant that results in many reservoir fish having methylmercury levels that pose a risk for humans and wildlife that eat the fish. Mercury does not impair drinking water quality in California reservoirs. The number of reservoirs determined to be impaired by mercury is expected to increase substantially as new fish tissue monitoring data are collected and evaluated. The Statewide Mercury Control Program for Reservoirs applies to the mercury-impaired reservoirs listed on Table S-2. Elevated fish methylmercury levels impair the following beneficial uses: commercial and sport fishing (COMM), wildlife habitat (WILD), and preservation of rare and endangered species (RARE).

Goals

To address the mercury problem in reservoirs, the State Water Resources Control Board (State Water Board) has undertaken a statewide program ("Statewide Mercury Control Program for Reservoirs"), which has the following main goals:

1. Reduce fish methylmercury concentrations in reservoirs that have already been determined to be mercury-impaired;
2. Have a control program in place that will apply to additional reservoirs when they are determined in the future to be mercury-impaired; and
3. Protect additional reservoirs from becoming mercury-impaired.

To achieve these goals, the State Water Board is proposing to establish a rule titled, "Amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Mercury TMDL and Implementation Program for Reservoirs" (hereinafter, Mercury Reservoir Provisions).

Scope

The Mercury Reservoir Provisions include several key elements. The first element is a program of implementation for achieving and maintaining mercury water quality objectives (see below) in reservoirs. The program of implementation includes control actions for (1) point and nonpoint sources of mercury, and pilot tests for (2) reservoir water chemistry to reduce methylmercury production and (3) fisheries management to reduce methylmercury bioaccumulation.

The second element consists of recommendations (1) to protect people who eat mercury-contaminated reservoir fish while pilot tests are underway and inorganic mercury source reductions are occurring, (2) directed to the California Department of Fish and Wildlife for fisheries management, and (3) directed to other agencies to ensure reductions in atmospheric mercury.

The third element is a "total maximum daily load" for mercury-impaired reservoirs (Reservoir Mercury TMDL).

S-2 Reservoir Definition

For this program, a reservoir is defined as a natural or artificial water impoundment that:

- Has constructed structures such as dams, levees, or berms to contain or otherwise manage water, and/or was excavated; and
- Provides year round habitat for fish other than those specifically introduced for vector control purposes.

Several types of impoundments are excluded, such as the following: potable water storage; industrial and mining supply water storage; wastewater treatment and storage; basins filled intermittently for flood control; and agricultural and ranching ponds.

S-3 Water Quality Objectives

There is a related but separate mercury water quality objectives project (see *link*) that includes several objectives to protect human and wildlife health for consumption of fish. These objectives will apply to reservoirs addressed by the Statewide Mercury Control Program for Reservoirs. Mercury water quality objectives are proposed for sport fish, prey fish, and small prey fish where least tern habitat is supported. However, only one or two of these three mercury objectives apply to any particular water body, including to reservoirs (see Table S-1).

The "sport fish objective" protects humans and applies to all reservoirs to protect wildlife. Average methylmercury concentrations should not exceed 0.2 milligrams of methylmercury per kilogram of fish (mg/kg wet weight). This objective protects humans for consumption of one meal per week of fairly large fish (i.e., legal size catch).

One of two prey fish objectives may apply to each reservoir to protect wildlife that eats very small fish (see Table S-1). If a reservoir supports California least tern habitat, then the "CA least tern objective" applies; average methylmercury concentrations should not exceed 0.03 mg/kg. If a reservoir does not support California least tern habitat, then the "prey fish objective" would apply; average methylmercury concentrations should not exceed 0.05 mg/kg.

S-4 Implementation Plan

Achieve all applicable targets

One or two TMDL targets (see S-7) are applicable to each mercury-impaired reservoir. (These TMDL targets correspond to the one or two mercury water quality objectives applicable to each reservoir.) This implementation plan is designed to achieve all applicable targets in mercury-impaired reservoirs.

Phases and program review

Implementation would occur over two phases. Table S-2 lists the mercury-impaired reservoirs that would be included in Phase 1 and mercury-impaired reservoirs with Federal Energy Regulatory Commission hydropower licenses that would be addressed in the future. Phase 1 is expected to last for 10 years, after which the State Water Board will conduct a program review.

This program review will determine effective and feasible reservoir management actions based on results of the reservoir pilot tests (described below) and will develop Phase 2 implementation requirements. In Phase 2, requirements would be applied to additional reservoirs and corresponding mercury sources as the reservoirs are determined to be mercury-impaired by the Water Boards[1]. Initiating Phase 2 would require a future amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California.

[1] "Water Boards" refers collectively to the State Water Board and nine Regional Water Quality Control Boards.

Reservoirs and mercury control actions

The mercury control actions apply to different sets of reservoirs as follows:

- Mercury source control actions for dredging and studies needed for atmospheric deposition apply statewide;
- Recommendations for exposure reduction apply to all reservoirs and are particularly needed for impaired reservoirs;
- Control actions apply to many mercury sources upstream of impaired reservoirs; sources such as mines, urban runoff (storm water), and municipal and industrial facility discharges (non-stormwater).
- In Phase 1, reservoir water chemistry and fisheries management pilot tests apply to mercury-impaired reservoirs that do not have a Federal Energy Regulatory Commission hydropower license; and
- Mercury source and methylation control actions for new reservoirs.

Effective date

After the State Water Board adopts the Mercury Reservoir Provisions, the Mercury Reservoir Provisions are effective upon approval by the California Office of Administrative Law. The effective date is the beginning of Phase 1.

Applicability to existing mercury TMDLs

The Reservoir Mercury TMDL will not apply to Clear Lake (Lake County), Soulajule Reservoir (Marin County), and Guadalupe River Watershed (Santa Clara County) reservoirs downstream of Vasona Dam or downstream of New Almaden mining district because mercury TMDLs were previously adopted by the Regional Water Boards for these reservoirs.

In contrast, the Reservoir Mercury TMDL will supersede the mercury TMDL for Hernandez Reservoir previously adopted by the Central Coast Regional Water Board. Additionally, both the Reservoir Mercury TMDL and USEPA-established mercury TMDLs (in the Los Angeles Area Lakes TMDL for nitrogen, phosphorus, mercury, trash, organochlorine pesticides, and PCBs) will apply to the El Dorado Park Lakes, Puddingstone Reservoir, and Lake Sherwood.

S-5 Key Actions in Phase 1

Reservoirs: Pilot tests

Owners and operators of mercury-impaired reservoirs (see Table S-2) would conduct pilot tests of methods to reduce methylmercury concentrations in reservoir fish. Hydroelectric power reservoirs (i.e., licensed by Federal Energy Regulatory Commission) would be excluded from mercury pilot test requirements in Phase 1. Coordinated pilot tests could be conducted in fewer, targeted reservoirs rather than in all impaired reservoirs. Reservoir owners and operators would convene a third-party independent Technical Review Committee to advise on pilot tests.

Reservoir owners and operators would use lessons learned from pilot tests to develop long-term reservoir and fisheries management plans. In program review after Phase 1, the Technical Review Committee and the State Water Board would evaluate results of pilot tests and long-term reservoir and fisheries management plans.

Potential pilot tests

Manage reservoir water chemistry to reduce methylmercury production:

- Oxidant addition to reservoir bottom waters (near the sediment-water interface) to reduce anoxia or adjust redox potential when reservoirs are stratified to suppress methylation of mercury. Evaluate various oxidants (e.g., dissolved oxygen, ozone, nitrate, others) for (a) efficacy for methylmercury reduction, (b) multiple benefits (e.g., drinking water quality, algal controls), and (c) avoidance of adverse consequences;
- In-reservoir sediment removal or encapsulation to address inorganic mercury hotspots such as submerged or near-shore mine sites and mining waste; and
- Other management practices to reduce methylation, including enhancing demethylation.

Manage fisheries to reduce fish bioaccumulation of methylmercury:

- Nutrient management such as minimal additions of nitrogen or phosphorus (including from natural sources such as restoring historical salmon runs) to slightly increase chlorophyll-a concentrations in oligotrophic reservoirs;
- Intensive fishing to increase the growth rate of remaining fish;
- New or changes to fish stocking practices to increase the abundance of fish with lower methylmercury levels, such as (a) stock low-methylmercury prey fish for reservoir predator fish to consume, (b) stock more or different sport fish species, such as lower trophic level sport fish, and/or (c) stock large, old predator fish from hatcheries that supply low methylmercury fish; and
- Assess potential changes to make to fish assemblage that result in top predator fish with lower methylmercury levels.

Mine sites upstream of reservoirs

The Water Boards would compel, using existing authorities, cleanup of the highest priority mine sites upstream of mercury-impaired reservoirs. Cleanup of highest priority mine sites is expected to reasonably quickly decrease reservoir mercury concentrations.

Exposure reduction

Human health should be protected while pilot tests are underway and inorganic mercury source reductions are occurring. This would involve reservoir owners and operators, the State Department of Public Health, Office of Environmental Health Hazard Assessment, and other stakeholders, for actions such as the following:

- Post fish consumption warning signs;

- Recommend fish catch restrictions to reduce human consumption of larger, older fish with high methylmercury levels, e.g., “slot limits” that specify a safe size range of fish for consumption; and
- Conduct public outreach and educational activities to discourage people from consuming fish with highly elevated methylmercury.

Atmospheric deposition

The California Air Resources Board and USEPA should evaluate atmospheric deposition of mercury to California. California already reduced anthropogenic emissions of mercury by more than half since 2001 and is expected to achieve the load allocation (see “Reservoir Mercury TMDL” section) by the end of Phase 1. The Water Boards would encourage USEPA to increase its efforts to address mercury emissions from foreign countries (particularly artisanal gold mining on several continents and power plant emissions in Asia).

S-6 Other Actions in Phase 1

Urban runoff to Mercury-Impaired Reservoirs (Storm water NPDES Dischargers)

“MS4 permittees” are responsible for urban runoff from municipal separate storm sewer systems (MS4s) regulated by National Pollutant Discharge Elimination System (NPDES) permits. Large MS4 permittees in highly urbanized areas would monitor methylmercury in their discharges upstream of or directly to mercury-impaired reservoirs. In program review after Phase 1, the State Water Board would evaluate these data as a first step toward determining whether methylmercury controls from MS4 permittees are needed.

MS4 permittees located upstream of mercury-impaired reservoirs that contain historical mercury mine sites, or gold or silver mine sites where mercury was used, would ensure that earth-moving projects will employ erosion and sediment control best management practices to prevent discharge of mercury.

Municipal and Industrial Wastewater Facility Discharges to Mercury-Impaired Reservoirs (Non-Stormwater NPDES Dischargers)

The Water Boards would include the following in the next permit cycle for NPDES-permitted municipal and industrial wastewater facilities that discharge upstream of or directly to impaired reservoirs:

- Mercury numeric effluent limitations based on waste load allocations (see “Reservoir Mercury TMDL” section);
- Require dischargers to monitor total mercury in effluent; and
- Require dischargers with treatment pond systems to monitor methylmercury in effluent for up to two years.

In program review after Phase 1, the State Water Board will evaluate these data as a first step toward determining whether methylmercury controls are needed for discharges from treatment pond systems.

Dredging and earth-moving

The Water Boards issue certifications or permits for projects such as dredging in reservoirs and creek channels downstream of mine sites, and earth-moving projects such as construction of roads and watercourse crossings near mines. Future certifications and permits would include requirements for erosion and sediment control best management practices to prevent discharge of mercury.

S-7 Reservoir Mercury Total Maximum Daily Load

This Statewide Mercury Control Program for Reservoirs would establish a total maximum daily load for mercury-impaired reservoirs (Reservoir Mercury TMDL) that would include the following elements.

Numeric targets

Three targets, one set equal to the sport fish objective, one set equal to the CA least tern objective, and one set equal to the prey fish objective. The targets apply to the impaired reservoirs corresponding to the mercury objectives. One or two of these three mercury targets apply to each mercury-impaired reservoir (see Table S-1).

Source assessment

Mercury sources are not evenly distributed across the State and no one source type is responsible for all reservoir impairments. The most important anthropogenic sources to impaired reservoirs are historical mine sites and atmospheric deposition from global and California industrial emissions.

Mercury is naturally-occurring in many geologic formations. Natural background (pre-industrial) concentrations in soils and sediments reflect naturally-occurring mercury from native geologic formations and volcanoes. California's Coast Ranges have some of the world's most productive mercury mines, and much of this mercury was used in gold mines in the Sierra Nevada and elsewhere.

Modern background soil mercury levels are elevated above natural background because mercury emissions and associated atmospheric deposition have increased greatly since the dawn of the industrial era. "Atmospheric deposition" is the term for this source after emissions settle onto the landscape or water surface. National and global emission inventories indicate that California anthropogenic emissions have decreased substantially in recent years while emissions from Asia have increased.

Historical gold, silver, and mercury mining activities were widespread in many of California's watersheds, and most mining activities occurred upstream of reservoirs. Yet, many mercury-impaired reservoirs downstream of mines do not have elevated sediment mercury concentrations.

In contrast to mines upstream of reservoirs, the majority of California's urban areas are downstream of reservoirs. NPDES-permitted urban runoff and treated wastewater facility discharges are generally insignificant sources of mercury.

Linkage analysis

There is a relationship between fish methylmercury concentrations and the environmental factors that control methylmercury production, bioaccumulation, and biomagnification in California reservoirs. More than 70 environmental factors have been assessed using statistical analyses and model development based on data collected from California reservoirs.

The linkage analysis indicates that no single factor explains fish methylmercury concentrations in California reservoirs. Multiple factors drive reservoir fish methylmercury levels: amount of mercury, methylmercury production, and bioaccumulation. The ratio of aqueous methylmercury to chlorophyll-a, aqueous total mercury, and annual reservoir water level fluctuations explain greater than 85% of the variability in reservoir fish methylmercury concentrations.

TMDL and loading capacity

The Reservoir Mercury TMDL and loading capacity for reservoirs is the sum of:

- Inorganic mercury waste load allocations for large and small NPDES-permitted discharges from municipal and industrial facilities;
- Inorganic mercury load allocations for mining waste, soils, and atmospheric deposition; and
- Methylmercury load allocation for in-reservoir methylmercury production.

The load allocations for soils and atmospheric deposition include natural background.

Waste Load Allocations (WLAs) for point sources

Facilities with individual NPDES permits are categorized as large, small, or negligible dischargers based on a comparison of their design flows to reservoir inflows. The WLAs are based on current performance and expressed as concentrations (nanograms of total mercury per liter [ng/L], calendar year average), as follows:

- Large municipal waste water treatment plants (WWTPs): 10 ng/L
- Other large facilities: 30 ng/L
- Small WWTPs: 20 ng/L
- Other small facilities: 60 ng/L

No WLAs are proposed for NPDES-permitted facilities with negligible discharges.

No WLAs are assigned to urban runoff discharged by MS4 entities and stormwater discharged by construction and industrial activities because mercury in these discharges is accounted for in the load allocations for atmospheric deposition.

Load allocations for nonpoint sources

Total mercury load allocations for mining waste and soils are based on mercury regions in California and expressed as concentrations (milligrams of mercury per kilogram of soil [mg/kg, dry weight, annual median]), as follows:

- 0.1 mg/kg for trace mercury areas;
- 0.3 mg/kg for mercury-enriched areas; and
- 400 mg/kg or a site-specific cleanup standard for mercury mineralized zone. (This mercury concentration is characteristic of background levels observed at mercury mine sites in the Coast Ranges.)

The statewide total mercury load allocations for atmospheric deposition are expressed as loads (kilograms of mercury per year [kg/yr]), as follows:

- 1,400 kg/yr for deposition from natural sources;
- 230 kg/yr for deposition from anthropogenic sources within California; and
- 1,600 kg/yr for deposition from anthropogenic sources outside of California.

The load allocation for in-reservoir methylmercury production is no detectable methylmercury in unfiltered reservoir water (calendar year median for the entire water column, including the epilimnion and hypolimnion) with a detection limit of 0.009 ng/L.

Tables

Table S-1. Applicability of Numeric Targets

	Highest Trophic Level in Reservoir (TL4 Fish)	**Highest Trophic Level in Reservoir (TL3 Fish)**
Not habitat for California least tern	sport fish target applies	sport fish and prey fish targets apply
Habitat for California least tern	sport fish and CA least tern targets apply	sport fish and CA least tern targets apply

Table S-2 is provided on the following pages.

Table 9.3: Preliminary List of Reservoir Pilot Tests

This is a recommended list of types and quantities of potential water chemistry and fisheries management pilot tests and associated studies. The type and quantity of pilot tests approved in the future by the Water Boards may be substantially different.

Reservoir water chemistry			
Pilot test	**Study**	**Number of pilot tests**	**Oxygen addition to reduce anoxia**
Test		3	Identify potential pilot test sites. Criteria include, but are not limited to: reservoir stratifies, different methods of adding oxygen (circulators, bubblers, line diffusers, Speece cone, or other)
	Study		Follow oxygenation pilot tests already underway to address mercury by the Santa Clara Valley Water District in: Almaden Reservoir, Lake Almaden, Calero Reservoir, and Guadalupe Reservoir. The corresponding reference sites are: Stevens Creek Reservoir (oxygenated) and Lexington Reservoir (no mercury controls).
	Study		Where oxygenation systems are already installed and operating for reasons other than mercury, study their effects on mercury methylation and bioaccumulation. For example, study the following 5 reservoirs: (1) Indian Creek Reservoir, South Tahoe Public Utility District (2 & 3) Calaveras Reservoir and San Antonio Reservoir, City & County of San Francisco (4 & 5) Camanche Reservoir and Upper San Leandro Reservoir, East Bay Municipal Utility District For comparison to Camanche Reservoir, study conditions in other Sierra Nevada reservoirs at similar elevations that have high dissolved oxygen levels and elevated methylmercury levels in fish (possibly Lake Combie, Rollins Reservoir, and/or Camp Far West Reservoir).
	Study		Obtain lessons learned from abandoned oxygenation systems. For example: Lake Mendocino, USACE
	Study		Where oxygenation is planned to be installed soon for reasons other than mercury, collect pre-oxygenation mercury baseline data and study effect of oxygenation on methylation and bioaccumulation: Lake Hodges, City of San Diego
			Pilot test nitrate addition to adjust redox potential
Pilot		1	Potential pilot test site: Lafayette Reservoir, East Bay Municipal Utility District
			Pilot test in-reservoir sediment remediation to address inorganic mercury hotspots such as submerged or near-shore mine sites or mining waste
Pilot		3	Potential pilot test sites: Lake Herman, City of Benicia Marsh Creek Reservoir, Contra Costa County Flood Control & Water Conservation District Lake Nacimiento, Monterey County Water Resources Agency (USEPA has already collected substantial baseline data)

Table 9.3: Preliminary List of Reservoir Pilot Tests

			Study source control by others
	Study		Study effects of mining waste remediation by others. Collect reservoir baseline data prior to remediation, collect reservoir post-remediation data, and compare pre- and post-remediation data to evaluate effects of mining wasteremediation on reservoir fish methylmercury levels.
			Davis Creek Reservoir, Homestake Mining Co.
			Marsh Creek Reservoir, Contra Costa County Flood Control & Water Conservation District
			Lake Nacimiento, Monterey County Water Resources Agency (USEPA has already collected much baseline data)
	Study		Study effects of expected reductions in local air emissions. Obtain emissions information and determine if reductions in mercury in local air emissions have likely occurred. If more data needed, determine parameters (e.g., mercury atmospheric deposition rate, fish methylmercury concentration) and collect reservoir data. Evaluate effects of lower emissions on reservoir fish methylmercury levels. (Recent [2013] fish samples have been collected in Puddingstone Reservoir.)
			El Dorado Park Lakes, City of Long Beach
			Indian Valley Reservoir, Yolo County Flood Control & Water Conservation District
			Puddingstone Reservoir, Los Angeles County Department of Public Works
	Study		Study whether external (watershed) methylmercury sources are important factors for elevated fish methylmercury levels in reservoirs. Identify critical management questions and corresponding testable hypotheses and test sites. Studies should be coordinated with other mercury and methylmercury monitoring efforts, for example, methylmercury monitoring required by this program for urban runoff (section 9.5) and NPDES-permitted facilities (section 9.7).
			Other water chemistry studies
	Study		Follow pilot tests currently being designed by Marin Municipal Water District for Soulajule Reservoir (reference site to be determined)
Reservoir fisheries management			
			Pilot test small amounts of nutrient additions to oligotrophic reservoirs
Test		3	Identify potential pilot test sites. Criteria include, but are not limited to: oligotrophic, no drinking water intakes (to eliminate the possibility that nutrient additions might contribute to a blue-green algal bloom in a potable water supply), and downstream waters not 303(d)-Listed as impaired for nutrients.
			Pilot test different stocking practices
Test		5	Pilot test different strategies for managing stocking of brown trout and other fish species that accumulate high levels of methylmercury: Hell Hole Reservoir, Placer County Water Agency (brown trout here especially) Lake McClure, Merced Irrigation District Millerton Lake, New Melones Lake, and Shasta Lake, USBR Lake Oroville, DWR Pine Flat Lake, USACE
Test		2	Pilot test effect of (increased) stocking of rainbow trout on methylmercury levels in predatory fish: Prosser Creek Reservoir and Stampede Reservoir, USBR

Table 9.3: Preliminary List of Reservoir Pilot Tests

			Study other fisheries management methods
	Study		Study Toluca Lake and others [(1)] to determine why largemouth bass methylmercury levels were so low in 2007 (Davis et al. 2010; 0.01 mg/kg in 350 mm standardized size largemouth bass, range 0.012 to 0.097 mg/kg, and n = 10). If possible, determine whether these low levels are due to controllable factors that can be used in other reservoirs to reduce fish methylmercury levels. Use this information to propose future pilot tests of these methods in appropriate reservoirs.
	Study		Study reservoirs with and without carp, but similar in other ways, to compare methylmercury production and bioaccumulation in several fish species.
	Study		Study paired reservoirs with very different stocking rates to see if stocking reduces methylmercury bioaccumulation into bass.
	Study		Conduct and evaluate creel surveys in reservoirs where a “mixed bag” (mix of fish from trophic levels 3 and 4) might be appropriate for water quality objective application. If this evaluation appears to support objective application using a mixed bag, collect additional fish data to determine methylmercury levels in a mixed bag of sport fish consumed by humans, and methylmercury levels in prey fish consumed by piscivorous birds. Evaluate fish data to determine if the reservoir may not be impaired by mercury when applying mixed bag.
	Study		Study intensive fishing (culling). Study effects of ongoing carp culling on methylmercury levels in rainbow trout and other species in Big Bear Lake owned by Big Bear Municipal Water District.
	Study		Where culling might be used to preserve native fish species, collect pre-culling (baseline) fish methylmercury data and post-culling methylmercury data to study effect of culling on bioaccumulation. A potential bass culling site is the Upper San Leandro Reservoir, owned by East Bay Municipal Utility District. Potential sites for culling of non-native carp and bass are Chesbro Reservoir, Coyote Lake, Stevens Creek Reservoir, and Uvas Reservoir, owned by the Santa Clara Valley Water District.
There are many other potential pilot test sites identified on Table 7.1 and discussed in Appendix H, Table H.1 Notes.			
		17	**Total of preliminary pilot tests**

Table 9.3 Footnotes:	
1	Other lakes that have very low methylmercury levels in largemouth bass include the following: Lake of the Pines, Lake Calabasas, Prado Lake, Lake Evans, Dixon Lake, Lake Poway, and Lake Wohlford (Davis et al. 2010, p. 43).